PORTNEUF RIVER SUBBASIN
WATER QUALITY MONITORING REPORT
MAY 1999 – APRIL 2000

Developed for:

Portneuf Soil and Water Conservation District
Caribou Soil and Water Conservation District
Portneuf River Watershed Council
Idaho State Department of Agriculture
Idaho Soil Conservation Commission

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Technical Results Summary #1

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INTRODUCTION

Since May 1999, the Idaho Association of Soil Conservation Districts (IASCD) has been conducting water quality monitoring on numerous tributaries to the Portneuf River. IASCD has worked cooperatively with Idaho State Department of Agriculture (ISDA), Idaho Soil Conservation Commission (ISCC), Caribou Soil Conservation District, Portneuf Soil and Water Conservation District, and Natural Resources Conservation Service (NRCS). Many of the tributaries monitored are listed on the state of Idaho's 303(d) list for having water quality limited segments. The information collected by this study will be used in the agricultural portion of the implementation plan for the Portneuf River Total Maximum Daily Load (TMDL) Plan.

PROJECT OBJECTIVES

The objectives for the Portneuf River Monitoring program are to:

- Evaluate the impact of agriculture and rangeland on the tributaries and mainstem of the Portneuf River.
- Evaluate the water quality and discharge rates at various locations within these creeks.
- Attempt to determine which areas contribute to the greatest level of loading with respect to TMDL parameters.
- Locate future areas where best management practices (BMPs) may be implemented to reduce pollutant loads.
- Use this data for public awareness.

PORTNEUF TOTAL MAXIMUM DAILY LOAD REQUIREMENTS

The Portneuf River TMDL was completed by the Idaho Department of Environmental Quality (DEQ) in November 1998. The document was sent to Environmental Protection Agency (EPA) and was approved after substantial review. The TMDL lists bacteria, nutrients, sediment, and flow alteration as pollutants of concern within the Portneuf Subbasin. The IASCD monitoring plan for the Portneuf River did not address flow alteration. Pollutant concentrations for total phosphorus, total inorganic nitrogen, total suspended sediment, fecal coliform, and *Escherichia coli* are given in the Portneuf River Loading Analysis (Table 1).

Table 1. Pollutant concentrations for 303(d) listed segments in the Portneuf River TMDL.

Pollutant of Concern	Proposed Portneuf River TMDL Pollutant Concentrations
Total Phosphorus	0.075mg/L
Total Inorganic Nitrogen	0.3mg/L
Total Suspended Sediment	80mg/L during High Flow 50mg/L during Low Flow
Fecal Coliform	500 colonies/100mLs for Primary Contact 800 colonies/100mLs for Secondary Contact
Escherichia coli	406 colonies/100mLs for one time grab

LANDUSE

The Portneuf Subbasin makes up approximately 870,400 acres. The Portneuf River drains approximately 1,360 square miles and is about 100 miles long (Figure 1). Land classification is predominantly agricultural, range, and forest. The area evaluated for this project is approximately 313,306 acres.

Land ownership and landuse can influence water quality. Land ownership acres, associated with each monitored watershed, are displayed in Table 2, Appendix B. The landuse area of the catchments is shown in Table 3, in Appendix B.

MONITORING DESIGN AND METHODS

SITE LOCATIONS

A total of eighteen monitoring sites (Figure 1) were chosen to be monitored bi-weekly from April through September, then once a month from October through March. A complete year was monitored. The eighteen monitoring sites were spread throughout the entire watershed. Two monitoring sites are located on the upper section of the Portneuf River located in Caribou County. The remaining sixteen monitoring sites are located in Bannock County. The sites are Twentyfourmile, Eighteenmile, Dempsey, East Bob Smith, Birch, Hawkins, Garden, Goodenough, Bell Marsh, Marsh, Indian, Rapid, Webb, and Pocatello creeks. Refer to Figure 1 for a map of the Portneuf Subbasin with the individual sample site locations indicated.

The largest tributary to the Portneuf River is Marsh Creek. The Marsh Creek drainage sites are upper, middle, and lower Marsh Creek, Birch, Hawkins, Garden, Goodenough, and Bell Marsh creeks. Indian Creek enters the Portneuf just below the confluence with Marsh Creek. Rapid Creek is the next largest drainage and the monitoring sites are upper and lower Rapid Creek and Webb Creek. Twentyfourmile and Eighteenmile are within the upper Portneuf River. The North Fork and South Fork of Pocatello creeks drain

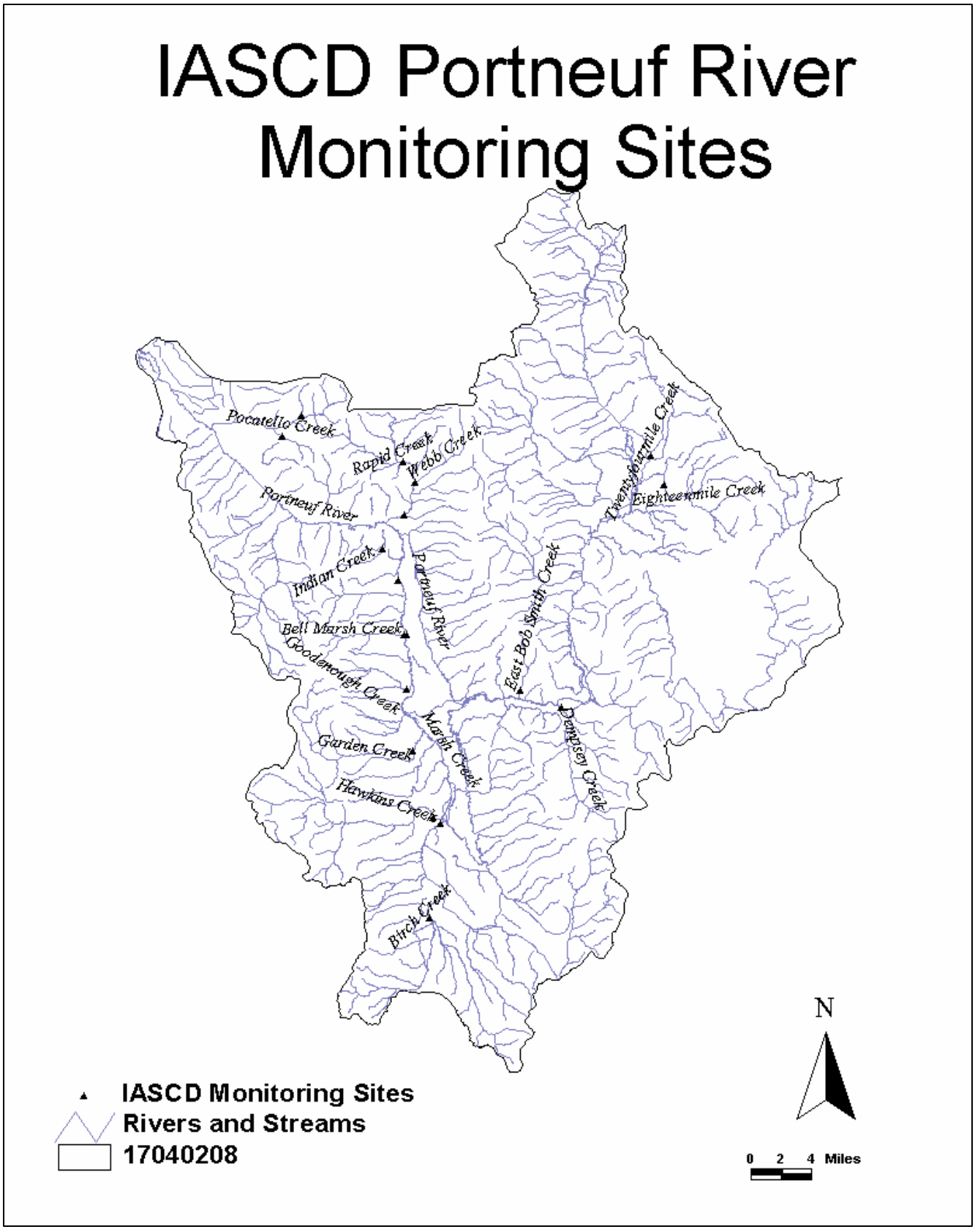

Figure 1. Portneuf Watershed HUC 17040208 with IASCD monitoring sites.

through the City of Pocatello. Dempsey and East Bob Smith creeks are small tributaries to the Portneuf River.

Eighteenmile, East Bob Smith, Dempsey, and Webb creeks are not on the State 303(d) list. Webb Creek has high water quality due to the previous installation of protection measures. IASCD chose Webb Creek as a reference stream for comparison to the other streams within the subbasin. Dempsey Creek was chosen as a duplicate site for Quality Assurance/Quality Control of the laboratory procedures and sample handling by the field staff.

SAMPLING AND TESTING METHODS

The sampling took place for a full year to encompass the high flow and low flow conditions for each stream. During high flow, some streams were inaccessible (due to safety concerns) and no samples were collected. Sampling on most of the streams began early May 1999 and continued until late April 2000. Some of the streams that are impacted will have state and federal cost share programs for BMP installations and will have an additional year of monitoring.

Samples for water quality analyses were collected by depth integrated or grab sampling directly form the source. The sampling plan entitled *Portneuf River Monitoring Project: A Water Quality Sampling Project for the Portneuf River's Tributaries* (1999) was followed. Each sample was analyzed for total suspended solids, total volatile solids, nitrate, nitrite, ammonia, total Kjeldahl nitrogen, total phosphorus, ortho phosphorus, fecal coliform, and *E. coli*. EPA certified methods were performed at IAS-EnviroChem in Pocatello, Idaho. In addition to these analytical tests, on-site field parameters for dissolved oxygen, temperature, conductivity, total dissolved solids, pH, and discharge were measured during each sampling event.

RESULTS

WATER QUALITY

The Portneuf River TMDL has concentration standards for total suspended sediment, total inorganic nitrogen ($NO_3 + NO_2 + NH_4$), and total phosphorus. Mean concentrations for the eighteen monitoring sites are compared to the TMDL standards (Table 4). Some samples could not be collected at certain sites due to low or stagnant summer water conditions. In addition, some samples were not collected during the winter months due to inaccessibility caused by high velocities and ice cover. Averages for total suspended sediment were based on high flow and low flow conditions. Averages for total inorganic nitrogen and total phosphorus were based on the months that data was collected. The highlighted values in Table 4 indicate where the TMDL concentration standard was exceeded.

Table 4. Portneuf River TMDL proposed standard and IASCD monitoring sites data.

Site Location	Mean Total Suspended Sediment (mg/L)		Mean Total Inorganic Nitrogen (mg/L)	Mean Total Phosphorus (mg/L)
Season of Sampling	High Flow	Low Flow	Year Round	Year Round
TMDL proposed standards	**80 mg/L**	**50 mg/L**	**0.3 mg/L**	**0.075 mg/L**
Eighteenmile	14	4	0.47	0.05
Twentyfourmile	61	22	0.52	0.09
Dempsey	98	17	1.14	0.09
Dempsey (duplicate)	95	16	1.11	0.10
East Bob Smith	81	13	1.03	0.08
Upper Marsh	36	64	0.86	0.12
Middle Marsh	117	28	1.30	0.15
Lower Marsh[1]	No data	29	1.13	0.04
Birch	80	43	1.08	0.10
Hawkins	236	198	1.56	0.44
Garden	165[2]	29	1.21	0.20
Goodenough[3]	58	8	0.63	0.07
Bell Marsh	28	30	0.90	0.07
Indian	52	13	0.98	0.08
Upper Rapid[4]	138	19	1.66	0.22
Lower Rapid[5]	55	10	1.56	0.11
Webb	13	3	0.97	0.06
N. Fk. Pocatello	67	64	2.53	0.21
S. Fk. Pocatello	75	44	1.65	0.18

[1] the discharge was too high from December to May to collect samples
[2] there was an outlying TSS reading that was not factored into this number
[3] no data was collected from June to September due to no flow and in December and January due to ice
[4] a beaver complex was built in September, so there is four months of data
[5] the discharge was too high to get in for May

BACTERIA

The Portneuf River TMDL standards are set as a one time grab. A one time sample should not exceed the established standard. To obtain a more accurate indication of bacteria contamination, a geomean is calculated by taking no fewer than five samples over a 30-day period. During this study period, only one time grab samples were collected. In Appendix B, Tables 5 and 6 display the fecal coliform and *E. coli* counts for the Marsh Creek drainage. Tables 7 and 8, also in Appendix B, display the fecal coliform and *E. coli* counts for Rapid Creek, Pocatello Creek, Twentyfourmile Creek and the other sampled tributaries of the Portneuf River. The highlighted values indicate where the TMDL standard for bacteria has been exceeded.

The bacteria testing is conducted at IAS – EnviroChem. When there are a large number of bacteria colonies, samples are diluted prior to counting. In some cases there are still more colonies than can be counted and a Too Numerous To Count (TNTC) may be recorded. When the laboratory reported a TNTC result, a 2000 colony value was assigned for the sample.

DISCUSSION OF RESULTS

Twentyfourmile Drainage

Twentyfourmile Creek

Twentyfourmile Creek is located in the upper Portneuf Subbasin and flows into the Portneuf-Marsh Valley Canal section of the Portneuf River. There is a reservoir located on the creek and the monitoring site is located 5.6 miles below the reservoir. The Twentyfourmile Creek monitoring site does not exceed the TMDL standards for mean total suspended sediment during high or low flow (Table 4). The TMDL standard is exceeded for total inorganic nitrogen (0.52 mg/L) and for total phosphorus (0.09 mg/L) (Table 4). Fecal coliform exceeded the TMDL twice during the year, both times in the summer and *E. coli* exceeded the TMDL only once, also during the summer (Appendix B, Tables 7 and 8). The reservoir could act as a sink for sediment and nutrients.

Eighteenmile Creek

Eighteenmile Creek is a tributary to Twentyfourmile Creek. It is not listed on the 303(d) list. The Eighteenmile Creek monitoring site does not exceed the TMDL standards for mean total suspended sediment during high or low flow. The standard is not above the TMDL for mean total phosphorus and bacteria. Testing does indicate that mean total inorganic nitrogen (0.47 mg/L) exceeds the TMDL standard (Table 4).

Dempsey Creek

Dempsey Creek flows directly into the Portneuf River one mile downstream from Lava Hot Springs. The monitoring site is located below Lava Hot Springs Golf Course. Dempsey Creek monitoring results indicate that high flow mean values for total suspended sediment (98 mg/L) is above the TMDL standard (Table 4). The yearlong mean for total inorganic nitrogen (1.14 mg/L) and total phosphorus (0.09 mg/L) are also above the TMDL standards. The fecal coliform standard was exceeded once during July (Appendix B, Table 7).

Dempsey Creek also had a duplicate sample taken during every sampling event. In Appendix A, the quality control/quality assurance for each sample is evaluated as precision using Relative Percent Difference (RPD) calculations (Table 10).

East Bob Smith Creek

East Bob Smith is located near Lava Hot Springs and is a tributary to the Portneuf River. This stream is not 303(d) listed as being water quality limited, but was monitored as a comparison stream. The East Bob Smith Creek monitoring site exceeds the TMDL standard during high flow for mean total suspended sediment (81 mg/L) (Table 4). Yearlong means for total inorganic nitrogen (1.03 mg/L) and total phosphorus (0.08 mg/L) are also above the standards. TMDL standards were exceeded for fecal coliform and *E. coli* several times throughout the year (Appendix B, Tables 7 and 8).

Marsh Creek Drainage

Marsh Creek is the largest tributary to the Portneuf River. It enters the Portneuf River at Inkom. Three monitoring sites are located on Marsh Creek. Several Marsh Creek tributaries were also monitored.

Upper Marsh Creek

The upper Marsh Creek site incorporates the headwaters of the drainage, approximately 130,000 acres. The site is located directly below the confluence of Hawkins and Marsh creeks. Total suspended sediment during low flow (64 mg/L) exceeds the TMDL standard (Table 4). Yearlong mean total inorganic nitrogen (0.86 mg/L) and total phosphorus (0.12 mg/L) exceed the TMDL standards. Fecal coliform slightly exceeded the TMDL standard three times during the summer (Appendix B, Table 5). *E. coli* was not exceeded once during the study year (Appendix B, Table 6).

Middle Marsh Creek

The middle Marsh Creek site drains an additional land area of 61,530 acres. The site is located directly below its confluence with Bell Marsh Creek. The middle Marsh Creek monitoring site exceeds the TMDL standard during high flow for mean suspended sediment (117 mg/L) (Table 4). Mean total inorganic nitrogen (1.30 mg/L) and total phosphorus (0.15 mg/L) are also above the standards. Only once during the study period did bacteria counts exceed the TMDL for both fecal coliform and *E. coli* (Appendix B, Tables 5 and 6).

Lower Marsh Creek

The lower Marsh Creek site is below the confluence with Walker Creek. This lower Marsh Creek site drains a total of 203,306 acres. No data was collected at the lower Marsh Creek site from December to May due to unsafe high flows. This site exceeds the TMDL standard for total inorganic nitrogen (1.13 mg/L) (Table 4). The mean phosphorus and suspended sediment levels were below the standard, but since no data was collected during the high flow period the phosphorus and total suspended sediment levels may be skewed. During the short sampling period, the TMDL was not exceeded for either fecal coliform or *E. coli.*

Birch Creek

Birch Creek is a tributary to Marsh Creek near the headwaters of Marsh Creek. The monitoring site is located below the confluence with Cherry Creek. The Birch Creek monitoring site exceeds the TMDL standard during high flow for mean suspended sediment (80 mg/L) (Table 4). Yearlong mean total inorganic nitrogen (1.08 mg/L) and total phosphorus (0.10 mg/L) were also exceeded. Fecal coliform exceeded the standard several times during the study year and *E. coli* exceeded the standard once during August (Appendix B, Tables 5 and 6).

Hawkins Creek

The sampling site on Hawkins Creek is located approximately 6.5 miles below the only reservoir in the Portneuf Subbasin that is on the 303(d) list. Hawkins Reservoir is listed for dissolved oxygen, while the stream is listed for nutrients and sediment. Hawkins Creek does not always confluence with Marsh Creek due to water availability. The Hawkins Creek monitoring site exceeds the TMDL standards for mean suspended sediment during high flow (236 mg/L) and low flow (198 mg/L) (Table 4). The standards were also exceeded for mean total inorganic nitrogen (1.56 mg/L) and total phosphorus (0.44 mg/L). Fecal coliform and *E. coli* are exceeded several times during the study year (Appendix B, Tables 5 and 6).

Garden Creek

The Garden Creek monitoring site is located near the town of Robin. The monitoring site exceeds the TMDL standard for total suspended sediment during high flow (165 mg/L) (Table 4). Total inorganic nitrogen (1.21 mg/L) and total phosphorus (0.20 mg/L) are also above the standard. Bacteria levels exceeded the standard and were very high several times for both fecal coliform and *E. coli* (Appendix B, Tables 5 and 6).

Goodenough Creek

The Goodenough Creek monitoring site is located directly above Marsh Creek Road. During the summer all the water from Goodenough Creek is diverted above the monitoring site. TMDL standards were exceeded only for total inorganic nitrogen (0.63 mg/L) (Table 4). Bacteria levels did not exceed either standard.

Bell Marsh Creek

The Bell Marsh Creek monitoring site is located above the confluence with Marsh Creek. Most of Bell Marsh Creek water is diverted during the summer. At the Bell Marsh Creek monitoring site, total inorganic nitrogen (0.90 mg/L) exceeded the TMDL (Table 4). Fecal coliform and *E. coli* counts both exceeded the TMDL three times during the study year (Appendix B, Tables 5 and 6).

Indian Creek

Indian Creek enters the Portneuf River west of Inkom, below the Portneuf River confluence with Marsh Creek. The Indian Creek monitoring site exceeds the TMDL standard for total inorganic nitrogen (0.98 mg/L) and total phosphorus (0.08 mg/L) (Table 4). For both fecal coliform and *E. coli*, the standard is exceeded from the end of June through August (Appendix B, Tables 5 and 6).

Rapid Creek Drainage

Rapid Creek is the second largest tributary to the Portneuf River. It enters the Portneuf River in Inkom. Two monitoring sites were located on Rapid Creek and one site on Webb Creek. Webb Creek is a tributary to Rapid Creek.

Upper Rapid Creek

The upper Rapid Creek site is located below the confluence of the North Fork and West Fork of Rapid Creek. Only eight sampling events occurred prior to beavers entering the area and damming the creek. The upper Rapid Creek site exceeded the TMDL standard during high flow for mean suspended sediment (138 mg/L) (Table 4). Total inorganic nitrogen (1.66 mg/L) and total phosphorus (0.22 mg/L) are also above the standards. These levels may be somewhat skewed on the high side since sampling only occurred May though August. Fecal coliform exceeded the standard three times during the sampling period, and *E. coli* exceeded the standard once (Appendix B, Tables 7 and 8).

Lower Rapid Creek

The lower Rapid Creek site is located below the confluence with Jackson Creek. This monitoring site exceeded the TMDL standards for total inorganic nitrogen (1.56 mg/L) and total phosphorus (0.11 mg/L) (Table 4). Twice during the study period, during April and July, the standards for fecal coliform and *E. coli* were exceeded (Appendix B, Tables 7 and 8).

Webb Creek

Webb Creek is a major tributary to Rapid Creek. Webb Creek is not listed on the 303(d) list as being water quality limited. DEQ has listed Webb Creek through the Beneficial Use Reconnaissance Program as having high water quality. This site is used as a reference stream to compare the other monitoring sites. The Webb Creek monitoring site exceeds the TMDL standard only for total inorganic nitrogen (0.97 mg/L) (Table 4). This value is three times the TMDL standard for total inorganic nitrogen.

Pocatello Creek Drainage

The North Fork and South Fork of Pocatello Creek confluence at Parks Road before flowing though a culvert under the City of Pocatello. Pocatello Creek exits the culvert west of the city before entering the Portneuf River.

North Fork Pocatello Creek

The North Fork of Pocatello Creek flows adjacent to Pocatello Creek Road. During low flow the North Fork Pocatello Creek monitoring site exceeded the TMDL standard for mean suspended sediment (64 mg/L) (Table 4). Yearlong means for total inorganic nitrogen (2.53 mg/L) and total phosphorus (0.21 mg/L) exceed the standard. Fecal coliform was over the standard once during August and *E. coli* remained below the standard (Appendix B, Table 7).

South Fork Pocatello Creek

The South Fork of Pocatello Creek drainage contains more rural homes than the North Fork. The monitoring site on the South Fork exceeded the TMDL standards for total inorganic nitrogen (1.65 mg/L) and total phosphorus (0.18 mg/L) (Table 4). Fecal coliform and *E. coli* remained below the standards.

EXCEEDING WATER QUALITY SUMMARY

Many of the monitoring sites exceed the TMDL standards for mean total suspended sediment, total inorganic nitrogen and total phosphorus. For all the monitoring sites 41 percent during high flow and 17 percent during low flow equaled or exceeded the TMDL standards for mean suspended sediment. All the sites exceed the TMDL standard for mean total inorganic nitrogen. Approximately 72 percent of the sites exceed the TMDL standard for mean total phosphorus.

The monitored streams can be grouped into three categories based on whether total suspended sediment (TSS), total phosphorus (TP), and total inorganic nitrogen (TiN) exceed the TMDL standards (Table 11).

Table 11. Grouping of streams based on pollutants exceeded.

GROUP A: Exceeds TMDL for TSS, TP, and TiN	**GROUP B**: Exceeds TMDL for TP and TiN	**GROUP C**: Exceeds TMDL for TiN
Dempsey Creek	Upper Marsh Creek	Eighteenmile Creek
East Bob Smith Creek	Indian Creek	Lower Marsh Creek
Middle Marsh Creek	Lower Rapid Creek	Goodenough Creek
Birch Creek	North Fork Pocatello Creek	Bell Marsh Creek
Hawkins Creek	South Fork Pocatello Creek	Webb Creek
Garden Creek	Twentyfourmile Creek	
Upper Rapid Creek		

Group A exceed the TMDL for mean total suspended sediment, mean total phosphorus, and mean total inorganic nitrogen. Group B sites exceeds the TMDL for mean total phosphorus and mean total inorganic nitrogen. Group C exceed the TMDL for mean total inorganic nitrogen only.

CONCLUSIONS

The Portneuf River Subbasin monitoring project was successfully implemented and all the protocols in both the field and the laboratory were followed. The data collected during this project has and will be used to identify resource concerns, determine objectives, and guide resource inventories and additional monitoring.

Sediment and nutrients are primary pollutants in the Portneuf Subbasin. Mean yearlong total inorganic nitrogen is above the TMDL standards in all the monitoring sites. Sediment and total phosphorus are above the TMDL standards in numerous monitoring sites. The sources of these pollutants have not yet been determined. Sediment can come from streambank erosion, agricultural runoff, irrigation return flows, roads, and rainfall events. The Portneuf River TMDL divides sediment into high and low flow standards. High flow is during runoff conditions from February until May, and low flow is during base flow conditions from June through January.

RECOMMENDATIONS

The data in this report and these recommendations are to be used during the planning and implementation portion of the TMDL and for any conservation plan that may be placed within the subbasin. These implementation efforts will be carried out in coordination with the Caribou Soil Conservation and Portneuf Soil and Water Conservation Districts, ISCC, ISDA, IDEQ, IASCD, and NRCS. These are just a few of the groups needed to work together to improve the water quality of the Portneuf Subbasin. These recommendations will help to achieve that goal.

Monitoring:
IASCD monitoring will continue

- on Group A and B streams.
- where BMPs are implemented.
- where ground water quality can influence surface water quality.

Resource Inventories:
ISCC in conjunction with SCDs, NRCS, and IASCD is recommended to

- inventory agricultural pollutant sources on streams in Group A initially.
- determine agricultural sources for total inorganic nitrogen and total phosphorus in Group B.
- determine agricultural sources for total inorganic nitrogen for Group C.

Implementation Plan:
ISCC in conjunction with SCDs, NRCS, and IASCD could consider to

- include data from this report in the agricultural component of the implementation plan.
- focus BMP implementation efforts on streams in Group A initially.

TMDL Standard:
Regarding the total inorganic nitrogen standard set in the Portneuf River TMDL, this monitoring data indicates that all monitoring sites exceed the standard set by DEQ in the Portneuf TMDL. A review of the total inorganic nitrogen standard is recommended. The stream used in reference, meeting beneficial uses according to DEQ, has a mean that is three times the standard.

Education:
Use this report and monitoring work in the Portneuf Subbasin to educate the general public and landowners near and adjacent to streams.

REFERENCES

Department of Environmental Quality. 1998. Draft Portneuf River Loading Analysis. Idaho Department of Environmental Quality, Pocatello.

Idaho Association of Soil Conservation Districts. 1999. Portneuf River Monitoring Project.

APPENDIX A

Quality Control Results

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

The QA/QC procedure for this monitoring program conformed to those outlined in the "Water Quality Sampling Plan", prepared by the IASCD.

Intermountain Analytical Services- EnviroChem utilized EPA approved and validated methods. Method performance evaluations include quality control samples analyzed with a batch to ensure sample data integrity. Internal laboratory spikes and duplicates are all part of EnviroChem's quality assurance program.

Field QA/QC protocols consisted of duplicate samples and blank samples. The field blanks consisted of laboratory grade deionized water, transported to the field, and poured off into properly prepared sample containers. For filtered constituents, deionized water was transferred into the filtration unit, filtered, and the resultant filtrate was transferred into appropriate sample containers. The blank samples were used to determine the integrity of the field teams sampling handling, the cleanliness of the sample containers, and the accuracy of the laboratory methods. There were no constituents detected (above the method detection limits) for any of the blank samples submitted during this program.

With the exception of samples for bacteria analyses, the duplicate samples consisted of two sets of sample containers filled (in the field) with the same composite water from the same sampling site. All of the duplicate samples were collected from the same location (Dempsey Creek) May 1999 through April 2000. Samples for bacteriological testing were collected by filling two separate sterile sample containers directly from the source. The duplicate samples were not identified as such and entered the laboratory as blind duplicates. The duplicate samples were used to determine both field and laboratory precision. All of the QC samples were stored on ice and handled with the normal sample load for shipment to the laboratory.

Table 9. Duplicate Comparison, Mean and Standard Deviation

Parameters	Dempsey Cr. Mean	Duplicate Mean	Dempsey Cr. Standard Deviation	Duplicate Standard Deviation
TSS	55	54	69	69
TVS	11	12	15	16
Ammonia-N	0.03	0.03	0.02	0.02
Total Kjeldahl-N	0.43	0.40	0.24	0.19
Nitrate+Nitrite	1.11	1.08	0.27	0.19
Total Phosphorus	0.09	0.10	0.12	0.13
Ortho-Phosphorus	0.03	0.03	0.02	0.02

PRECISION

Relative percent difference (RPD) is the normal measure of precision when calculated from duplicate sample. As previously mentioned, the duplicates were collected in the field. The calculation for RPD is as follows:

$$RPD = \frac{(C_1-C_2)*100\%}{(C_1+C_2)/2}$$

Where: RPD = relative percent difference
C_1 = Larger of the two observed values
C_2 = Smaller of the two observed values

Table 10. Relative Percent Differences (duplicates)

DATE	Dempsey Total-P	Duplicate Total-P	RPD	Dempsey Ortho-P	Duplicate Ortho-P	RPD	Dempsey TSS	Duplicate TSS	RPD
5/11/99	0.2	0.22	9.5	0.025	0.025	0	88	86	2.3
5/25/99	0.49	0.52	5.9	0.025	0.025	0	268	272	1.5
6/9/99	0.11	0.11	0	0.025	0.025	0	94	92	2.2
6/23/99	0.06	0.06	0	0.025	0.025	0	26	25	3.9
7/7/99	0.025	0.025	0	0.025	0.025	0	1	2	66.7
7/22/99	0.025	0.025	0	0.025	0.025	0	8	17	72
8/4/99	0.025	0.025	0	0.025	0.025	0	5	5	0
8/17/99	0.025	0.025	0	0.025	0.025	0	5	6	18.2
9/8/99	0.025	0.025	0	0.025	0.025	0	1	1	0
9/21/99	0.025	0.025	0	0.025	0.025	0	5	4	22.2
10/5/99	0.025	0.025	0	0.025	0.025	0	9	9	0
11/3/99	0.025	0.025	0	0.025	0.025	0	16	15	6.5
12/21/99	0.08	0.07	13.3	0.025	0.025	0	34	35	2.9
2/2/00	0.025	0.025	0	0.025	0.025	0	53	51	3.8
2/28/00	0.025	0.025	0	0.025	0.025	0	25	25	0
3/28/00	0.21	0.22	4.7	0.025	0.025	0	137	137	0
4/12/00	0.15	0.16	6.5	0.025	0.025	0	102	102	0
4/24/00	0.13	0.13	0	0.12	0.12	0	105	94	11.1

Table 10. Continued

DATE	Dempsey Nitrate	Duplicate Nitrate	RPD	Dempsey TKN	Duplicate TKN	RPD	Dempsey Ammonia	Duplicate Ammonia	RPD
5/11/99	0.98	0.97	1.03	1	0.6	50	0.025	0.025	0
5/25/99	0.56	0.57	1.8	0.7	0.7	0	0.025	0.025	0
6/9/99	0.98	0.98	0	0.6	0.6	0	0.025	0.025	0
6/23/99	0.9	0.9	0	0.6	0.25	82.4	0.025	0.025	0
7/7/99	0.93	0.93	0	0.25	0.25	0	0.025	0.025	0
7/22/99	0.94	0.95	1.1	0.25	0.25	0	0.025	0.025	0
8/4/99	1.06	1.07	0.9	0.25	0.25	0	0.025	0.025	0
8/17/99	1.21	1.23	1.6	0.5	05	0	0.12	0.13	8
9/8/99	1.38	1.38	0	0.25	0.25	0	0.025	0.025	0
9/21/99	1.19	1.24	4.1	0.5	0.5	0	0.025	0.025	0
10/5/99	1.39	1.38	0.7	0.25	0.25	0	0.025	0.025	0
11/3/99	1.08	1.06	1.9	0.25	0.25	0	0.025	0.025	0
12/21/99	1.18	1.18	0	0.25	0.25	0	0.025	0.025	0
2/2/00	1.89	1.18	46.3	0.25	0.25	0	0.025	0.025	0
2/28/00	1.08	1.08	0	0.25	0.25	0	0.025	0.025	0
3/28/00	1.14	1.14	0	0.6	0.5	18.2	0.025	0.025	0
4/12/00	1.11	1.1	0.9	0.25	0.5	66.7	0.025	0.025	0
4/24/00	1.02	1.02	0	0.8	0.8	0	0.025	0.025	0

Table 10. Continued

DATE	Dempsey Fecal Coliform	Duplicate Fecal Coliform	RPD	Dempsey *E. Coli*	Duplicate *E. Coli*	RPD
5/11/99	6	13	73.7	1	11	166.7
5/25/99	114	128	11.6	74	86	15
6/9/99	82	78	5	22	28	24
6/23/99	100	116	14.8	34	40	16.2
7/7/99	890	830	7.0	90	170	61.5
7/22/99	460	440	4.4	70	80	13.3
8/4/99	410	440	7.1	260	280	7.4
8/17/99	90	80	11.8	20	20	0
9/8/99	280	290	3.5	60	90	40
9/21/99	240	240	0	60	70	15.4
10/5/99	80	90	11.8	30	40	28.6
11/3/99	20	16	22.2	16	16	0
12/21/99	28	20	33.3	4	8	66.7
2/2/00	12	8	40	2	2	0
2/28/00	12	12	0	8	12	40
3/28/00	44	44	0	28	24	15.4
4/12/00	12	12	0	12	12	0
4/24/00	20	24	18.2	8	8	0

Appendix B

Table 2. Ownership Area above the monitoring sites.

Land Use (Acres)	**BLM**	**BIA**	**Water**	**Private**	**State**	**USFS**	**Total**
Eighteenmile	3,726.2	0.0	0.0	13,183.6	3,285.7	0.0	20,195.5
Twentyfourmile	1,527.1	0.0	34.1	12,309.8	837.2	0.0	14,708.2
Dempsey	602.6	0.0	0.0	19,982.4	3,246.9	0.0	23,831.9
East Bob Smith	371.1	0.0	0.0	432.1	533.9	3,100.0	4,437.1
Upper Marsh	6,924.0	0.0	67.5	83,450.0	7,206.8	32,496.9	130,145.2
Middle Marsh	12,994.1	0.0	80.6	127,039.3	8,473.8	43,088.0	191,675.8
Lower Marsh	14,390.0	0.0	80.6	132,291.4	8,473.8	48,070.2	203,306.0
Birch	0.0	0.0	0.0	13,342.1	24.5	18,050.0	31,416.6
Hawkins	4,171.6	0.0	67.5	25,688.4	509.3	6,464.2	36,901.0
Garden	3,240.0	0.0	0.0	11,187.4	561.1	2,066.4	17,054.9
Goodenough	720.9	0.0	0.0	2,396.4	0.0	3,246.4	6,363.7
Bell Marsh	176.4	0.0	0.0	763.6	625.9	3,002.8	4,568.7
Indian	10.4	0.0	0.0	658.4	0.0	1,884.9	2,553.7
Upper Rapid	2,749.4	0.0	0.0	11,725.3	370.0	1,412.4	16,257.1
Lower Rapid	3,907.8	0.0	0.0	20,429.7	831.3	11,203.4	36,372.2
Webb	52.1	0.0	0.0	982.5	0.0	4,119.4	5,154.0
N.Fk. Pocatello	863.7	52.5	0.0	4,530.9	0.0	0.0	5,447.1
S.Fk. Pocatello	1,404.5	0.0	0.0	1,049.8	0.0	0.0	2,454.3
Total	**26,803.4**	**52.5**	**114.7**	**204,868.1**	**17,208.8**	**64,258.5**	**313,306.0**

Table 3. Land use area above the monitoring sites.

Land Use (Acres)	CRP	Non-Irrigated	Forest	Irrigated-Gravity Flow	Irrigated-Sprinkler	Range-land	Riparian	Urban	Water	Total
Eighteenmile	0	5,339	0	472	1,942	12,418	0	0	0	20,172
Twentyfourmile	1,064	0	0	0	1,520	11,906	73	87	34	14,683
Dempsey	5	0	17,701	623	188	5,145	0	0	0	23,663
East Bob Smith	0	0	1,757	0	98	2,583	0	0	0	4,437
Upper Marsh	13,976	46,444	28,881	4,508	9,595	23,465	0	0	300	127,169
Middle Marsh	24,832	62,997	41,087	11,040	12,893	34,459	923	0	314	188,544
Lower Marsh	25,885	65,964	42,250	11,548	12,893	39,671	1,650	0	314	200,174
Birch	3,732	4,098	15,294	1,089	887	5,043	0	0	0	30,143
Hawkins	3,279	16,605	4,931	1,030	2,858	7,253	0	0	68	36,024
Garden	2,695	2,911	7,248	634	1,582	1,831	0	0	0	16,900
Goodenough	328	1,596	1,917	851	0	1,673	0	0	0	6,364
Bell Marsh	451	365	1,496	0	0	2,234	19	0	0	4,564
Indian	216	352	0	143	0	1,843	0	0	0	2,554
Upper Rapid	1,263	0	199	1,135	0	13,629	0	0	0	16,226
Lower Rapid	2,018	2,801	2,419	2,501	61	26,540	0	2	0	36,342
Webb	272	0	1,681	263	0	2,940	0	0	0	5,155
N.Fk. Pocatello	482	2,290	0	0	0	2,668	0	0	0	5,441
S.Fk. Pocatello	0	69	0	0	0	2,386	0	0	0	2,454
Total	29,671	76,814	64,127	15,287	16,701	105,159	1,722	88	348	309,919

Table 5. Fecal Coliform results for the Marsh Creek drainage. Portneuf River TMDL proposed standard is set at **500 colonies/100 mLs of sample**.

Date	Upper Marsh	Middle Marsh	Lower Marsh	Birch	Hawkins	Garden	Good-enough	Bell Marsh	Indian
11 May 99	13	129		116	94	48	8	16	11
26 May 99	184	492		**546**	**508**	370	216	106	50
8 Jun 99	198	364		**612**	**582**	**Tntc**	44	16	140
22 Jun 99	398	**742**	212	322	**872**	**Tntc**		**790**	**684**
6 Jul 99	**510**	260	32	470	**980**	390		280	**810**
19 Jul 99	**560**	310	260	**620**	**Tntc**	**Tntc**		320	**930**
2 Aug 99	**520**	300	160	360		430		**Tntc**	**1680**
16 Aug 99	90	40	430	**1710**	**790**	**1630**			**1010**
7 Sep 99	110	120	20	**870**		490			410
22 Sep 99	150	100	100	140	**760**	150			140
6 Oct 99	110	70	40	350		10	50	**Tntc**	50
1 Nov 99	32	20	92	20		64	8	132	12
20 Dec 99	8	68		**604**	220	44		12	8
1 Feb 00	84	48		12		40			
28 Feb 00	20	96		2	322	104	2	20	24
30 Mar 00	2	44		12	212	136	2	2	4
11 Apr 00	28	404		188	84	**Tntc**	2	2	56
24 Apr 00	108	164		328		**648**	4	12	20

Table 6. *E. Coli* results for the Marsh Creek drainage. Portneuf River TMDL proposed standard is set at **406 colonies/100 mLs of sample**.

Date	Upper Marsh	Middle Marsh	Lower Marsh	Birch	Hawkins	Garden	Good-enough	Bell Marsh	Indian
11 May 99	5	1		1	43	1	9	6	12
26 May 99	116	362		352	392	284	62	24	46
8 Jun 99	122	326		398	394	**Tntc**	42	16	112
22 Jun 99	376	**670**	206	286	**842**	**Tntc**		**760**	**652**
6 Jul 99	280	110	180	340	**950**	80		140	**760**
19 Jul 99	150	130	240	330	**Tntc**	**Tntc**		130	**810**
2 Aug 99	350	150	140	300		390		**Tntc**	**1520**
16 Aug 99	90	40	310	**1230**	**750**	**870**			**870**
7 Sep 99	60	40	10	380		310			240
22 Sep 99	40	40	50	120	**680**	70			110
6 Oct 99	120	40	50	260		10	20	**Tntc**	30
1 Nov 99	36	16	68	12		32	2	104	16
20 Dec 99	12	44		12	72	12		2	12
1 Feb 00	44	28		8		12			
28 Feb 00	12	72		2	160	72	2	16	16
30 Mar 00	2	48		4	144	92	2	2	2
11 Apr 00	16	284		124	32	**Tntc**	2	2	36
24 Apr 00	128	108		224		**512**	4	12	12

Table 7. Fecal Coliform results for the Rapid Creek drainage, Pocatello Creek drainage, Twentyfourmile Creek drainage, and the small tributaries. Portneuf River TMDL proposed standard is set at **500 colonies/100 mLs of sample**.

Date	Upper Rapid	Lower Rapid	Webb	NFk Pocatello	SFk Pocatello	Dempsey/ Dempsey A	East Bob Smith	24 Mile	18 Mile
10-12May 99	51		1	14	59	6/13	133	109	117
25 May 99	**1200**		6	46	82	114/128	264	180	38
9 Jun 99	454		10	152	106	82/78	**522**	84	18
22,23 Jun 99	326	208	32	102	374	100/116	356	142	112
7,8 Jul 99	**850**	310	50	60	350	**890/830**	170	**910**	210
19,22 Jul 99	**500**	**1060**	110	440	190	460/440	110	320	20
2,4 Aug 99	230	470	**510**	410	110	410/440	300	**670**	
17,18 Aug 99	250	450	230	**540**	200	90/80	**710**	210	40
7,8 Sep 99		160	10	260	40	280/290	150	180	90
21,22 Sep 99		110	5	440	100	240/240	**1430**	250	90
5 Oct 99		170	20	50	50	80/90	**1210**	420	20
1,3 Nov 99		4	8	12	228	20/16	396	44	2
21 Dec 99		16	2	48	8	28/20	332	188	
1,2 Feb 00		28		4		12/8			
28 Feb 00		48	2	8	2	12/12	**Tntc**		
28,30 Mar 00		104	232	32	40	44/44	112	44	2
12 Apr 00		**624**	8	20	156	12/12	296	484	312
24-26 Apr 00		32	2	8	100	20/24	472	60	52

Table 8. *E. Coli* results for the Rapid Creek drainage, Pocatello Creek drainage, Twentyfourmile Creek drainage, and the small tributaries. Portneuf River TMDL proposed standard is set at **406 colonies/100 mLs of sample**.

Date	Upper Rapid	Lower Rapid	Webb	NFk Pocatello	SFk Pocatello	Dempsey/ Dempsey A	East Bob Smith	24 Mile	18 Mile
10-12May 99	1		1	1	1	1/11	1	33	3
25 May 99	**1200**		8	24	96	74/86	118	154	42
9 Jun 99	268		2	60	98	22/28	348	26	14
22,23 Jun 99	344	182	26	24	216	34/40	230	106	34
7,8 Jul 99	80	250	20	50	250	90/170	70	**940**	130
19,22 Jul 99	140	**580**	20	210	130	70/80	60	120	20
2,4 Aug 99	100	330	130	180	90	260/280	90	180	
17,18 Aug 99	150	190	40	240	200	20/20	360	30	20
7,8 Sep 99		110	5	240	50	60/90	80	80	70
21,22 Sep 99		40	5	360	5	60/70	**1310**	190	60
5 Oct 99		130	10	40	30	30/40	**860**	310	5
1,3 Nov 99		4	4	12	84	16/16	224	32	4
21 Dec 99		2	2	20	8	4/8	100	72	
1,2 Feb 00		8		2		2/2			
28 Feb 00		20	2	2	2	8/12	**Tntc**		
28,30 Mar 00		64	156	32	44	28/24	104	24	2
12 Apr 00		**484**	2	8	104	12/12	208	216	180
24-26 Apr 00		16	2	4	68	8/8	300	8	32